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NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

OF THE

COLLEGE OF AGRICULTURE AND
MECHANIC ARTS

WEST RALEIGH

FEEDING AND MANAGEMENT OF POULTRY FOR EGG PRODUCTION

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N. C. COLLEGE OF AGRICULTURE AND MECHANIC ARTS

THE NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

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Address all communications to

N. C. AGRICULTURAL EXPERIMENT STATION,
WEST RALEIGH, N. C.

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FEEDING AND MANAGEMENT OF POULTRY FOR EGG PRODUCTION

BY J. S. JEFFREY.

The production of eggs for market is generally considered the most profitable branch of poultry keeping.

Under proper conditions there is no reason why eggs should not be produced at a price that will allow a good margin of profit. This should be especially true of eggs produced on farms where the fowls may find a large part of their sustenance at no cost to the farmer, utilizing what would otherwise be waste products.

With a knowledge of what is necessary for the best results in egg production, the farmer should be able to supplement the natural resources of the farm in such a way that revenue from the hens would be largely increased by a small extra outlay for food.

The profitable production of eggs depends on several different conditions, any one of which being wrong may seriously handicap one's efforts for the production of eggs at a profit.

The stock which is to lay the eggs must be of the right kind and of suitable age. Comfortable houses must be provided to protect the stock from the wet and wind.

Proper food must be supplied in some way that is suited to the needs of the hens, and which does not call for too much labor on the part of the poultryman in its preparation and feeding.

All of these are important and necessary if the best results are to be obtained, but they will not bring success unless the houses are kept clean and free from mites.

STOCK

In considering the question of stock, it can be done without taking special account of the different breeds, as good layers may be found in almost any breed.

It is necessary, however, that the fowls of whatever breed have strong constitutions. A hen that lacks in vitality will never make a good layer or a breeder of good laying stock. If strength and vigor are lacking in the stock, failure is sure.

Fowls can be selected for strength and vitality very largely by their appearance and condition. The active, sprightly bird is likely to be strong. The hen that is first off the roost in the morning, always on the move, hunting for food, and the last to go to roost at night, is not apt to be a weakling. On the other hand, the hen that comes off the roost when you feed in the morning and sometimes goes back there after feeding, that does not care to scratch or forage

for food, is likely to be a weakling and on that account should be discarded as a breeder.

The male should be gallant, always on the move, looking after the

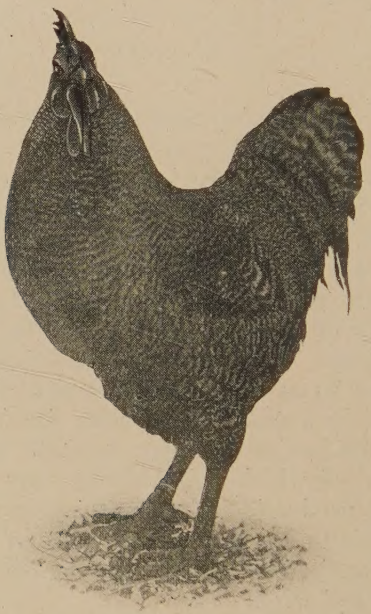

FIG. 1—A good vigorous Barred Plymouth Rock Cockerel.

FIG. 2—A Barred Plymouth Rock hen of good type.

hens and calling them when he finds anything especially tempting. He should have a loud, strong crow and should be masculine in appearance and carriage. Figs. 1 and 2 show birds of good vigor.

If stock of this kind is selected, the chances of success are much greater than they would be with stock bred from the very best layers that lacked in stamina and vigor.

A great deal has been written in regard to breeding up a heavy laying strain, and according to some it is one of the most simple problems that the poultryman has to solve. According to this class of writers, all that is necessary is to use trap nests to get the records of the different hens, select the heaviest layers as breeders, and success is assured. If this is true, heavy laying should be the rule rather than the exception. In our work it has been the exception to find that our heaviest laying hens are the best breeders of laying stock. Why this is so has not been definitely determined, but from our experience this plan can not be recommended.

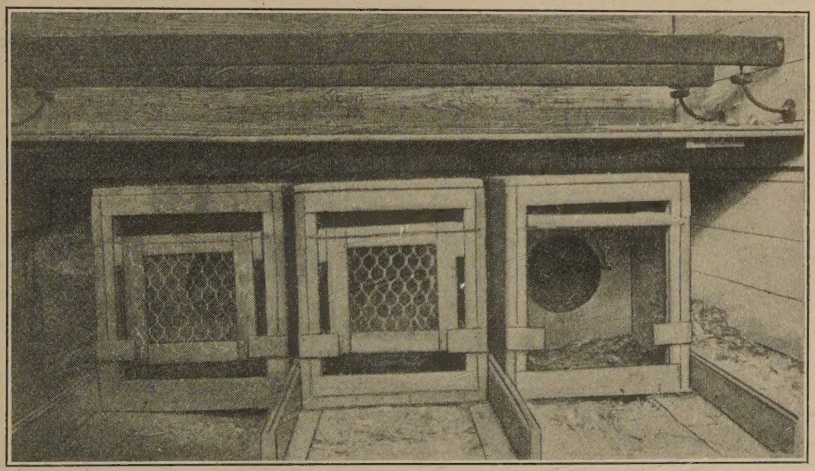

FIG. 3—Two compartment trap nests used at the Station.

It must not be thought from this that it is considered impossible to improve the laying quality of the flock by breeding, but in order to do so one must know more about the breeders, than simply how many eggs each hen has laid in a year.

Accurate pedigrees must be kept as well as the egg records, so that the breeding ability of the hens may be known as well as their egg production.

It has been found that hens of only medium value from the standard of egg production have sometimes been the best producers of good average laying stock. Under a method of selecting the best layers only for breeders these hens would have been discarded and their value as breeders never discovered.

It is not recommended that hens below the average of the flock in egg production be retained as breeders, but those giving yields up to

or about the average should be retained till their daughters can be tested.

The average egg production of a hen's daughters is a much better guide to her value as a breeder than the records of her ancestors.

In order to keep the pedigrees and get the individual egg records, a trap nest of some kind is necessary. Trap nests are generally made larger than ordinary nests, and in many cases are divided into two compartments. The ordinary sized nest is too small when the hen is confined as long as she sometimes is in the trap nest, and if there is only one compartment the egg is often broken by the hen becoming restless after she has laid. In the two-compartment nest

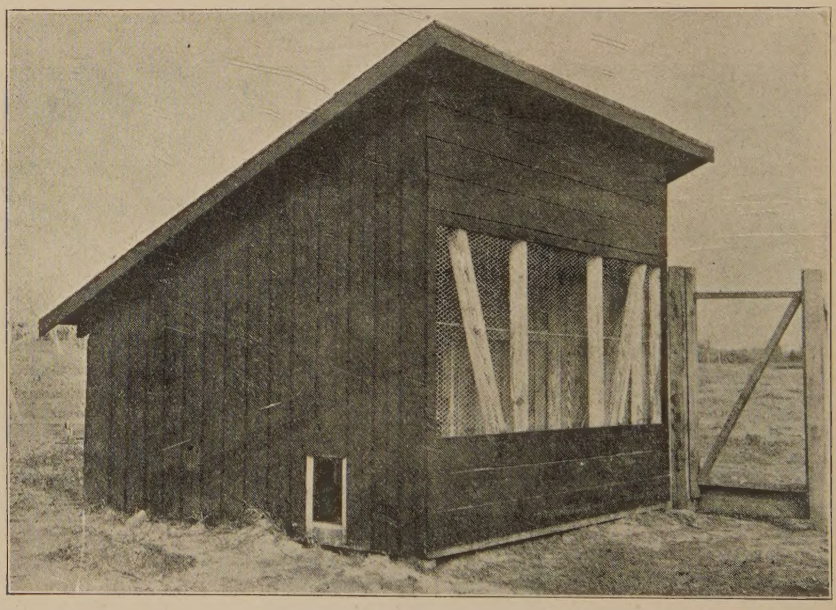

FIG. 4—Wire-front house with shed roof.

the back part is arranged for the nest proper and the front for the hen to wait in till the attendant releases her from the nest. Fig. 3 shows the trap nest used at the Station.

The problem of housing the fowls is not as serious in the South as it is in colder climates where the fowls are confined to the house for long periods by cold weather and snow. In this climate fowls spend more of their time in the yards or fields, even in winter, the houses being used only at night and as a protection against wet and the wind.

Even in the North the warm poultry house has been largely abandoned, as in most cases it was found that a closely built house,

while warmer, was not as satisfactory as the open-front house with its abundance of fresh, dry air.

Fowls are well protected by their feathers from the cold, but are not comfortable if exposed to wind or wet.

All the fowls used in Station experiments last year were housed in open-front houses, and there was not a single frozen comb in any of these.

A poultry house should be dry, have an abundance of fresh air without drafts, have all the sunlight possible, and should be so built that it can be kept clean and free from mites.

FIG. 5.—Wire-front house with long and short pitch roof.

The wire-front house supplies these conditions, and can be cheaply built. Figs. 4 and 5 show some types of wire-front houses and the scratching shed house in Fig. 6 has been converted into a wire-front house by removing the large sash from the windows of the roosting room.

No poultry house will be as dry as it should be unless it is on well-drained ground. If there is not good natural drainage, the ground should be raised to provide artificial drainage.

The house should face the south or southeast, so as to get as much sunlight as possible. Sunlight not only helps to keep the house dry, but is also a good germ destroyer. The opening in the front of the house should be so placed that the sunlight will get to the back of the house. For this reason the house shown in Fig. 4 is preferred to that in Fig. 5, as the opening is higher and the sunlight has a better chance to reach the back of the house.

Lice and mites are two of the worst foes of poultry, and as the latter live in the house, attacking the fowls when on the roost or in the nest, precautions should be taken in building the house to provide as few hiding places for them as possible.

Fig. 3 shows a stop-louse roost hanger which prevents mites traveling from the walls of the house to the roosts. All fixtures, such

FIG. 6—Scratching shed house used without sash in roosting room.

as roosts, dropping boards, and nests, should be movable, so that they can be taken out when the house is whitewashed or sprayed.

The scratching shed house shown in Fig. 6 is a very satisfactory house, and the hens have always done well in it, but it is more expensive to build than a single compartment house of the same size, and will not accommodate as many hens, as the roosting room is smaller.

In the wire-front houses (Figs. 4 and 5), we prefer the shed roof, as it is easier to build, the opening can be placed higher in the front, and a roof sloping to the north makes a cooler house in summer. The roofing facing the north will not be exposed to the sun as much as if facing the south, and should last longer. The scratching shed

house is set on a concrete foundation; the small open-front houses were raised a few inches above the ground and filled in with light, sandy soil. The ground around the house was also graded so as to give drainage away from the house.

The concrete foundation is best, but on account of the expense is not often used for small houses.

FOOD REQUIREMENTS OF THE HEN

The hen needs food to sustain life; to build up, develop, and repair waste tissues; and to supply heat and energy for the proper functioning of the body. What is fed above these needs goes to the production of meat or eggs.

The composition of the hen's body will vary with her condition, but may be said to contain about 55 per cent water, 22 per cent protein, 17 per cent fat, and 4 per cent ash.

An egg contains about 66 per cent water, 12 per cent protein, 10 per cent fat, and 12 per cent ash. Of the ash, practically all but about one per cent is from the shell.

A glance at these figures shows one the importance of a plentiful supply of pure fresh water. Water is not food, but without water food is of no use to the fowl. Animals as well as plants must have their food in solution before they can use it. When the food is digested it is taken up by the blood, which circulates through the body, nourishing and replenishing it.

Next to water, protein is the food element found in largest amount both in the hen and in the egg. This element builds up the body and repairs the waste tissues. Protein, although the principal nutrient used for a tissue builder, can also be used to take the place of carbohydrates and fat if these are not sufficiently supplied in the ration. It is not economy, however, to have this take place, as the protein is more expensive than the carbohydrates or fat.

Carbohydrates, which are principally starches, sugars, organic acids and pentosans, are used to produce heat and energy. They are the fuel and, while not found to any extent in the body of the hen or the egg, are very necessary in the ration and in fact form the largest part of it.

Fats have to a large extent the same function as carbohydrates. They have about two and one-quarter times the fuel value of carbohydrates, and it is customary in figuring the nutritive ratio of a ration to bring the carbohydrates and fats to a common value by multiplying the latter by two and one-quarter and adding the product to the carbohydrates. Fats also act as a storehouse for surplus supplies on which the fowl can draw when necessary.

Ash or mineral matter is also needed for the bones of the fowls and for the shell of the eggs.

Protein is found more or less in all grains; legumes, such as peas and beans, having more than grain such as corn and wheat. Cotton-seed meal, linseed meal, the meat meals, and beef scrap contain more protein than the grains do, and some of these products are often used to supply this nutrient.

Carbohydrates form a large part of most grains and grasses. Corn is perhaps the best example among the grains of a carbonaceous feed, containing as it does 70 per cent carbohydrates and 5 per cent of fat. Fat is also found more or less in most grains, corn and oats containing more than wheat or barley. Meat meal and beef scrap also contain from 5 per cent to 20 per cent fat.

Ash is not found in grains to any large extent, corn having only 1.5 per cent and oats 3 per cent. Wheat bran and middlings have more, the former on an average having nearly 6 per cent and the latter 3.3 per cent.

Some of the animal feeds, such as beef scrap and bone meal, supply larger proportions of ash, and the results of our feeding experiments indicate that a larger percentage of ash is needed than is supplied by grain and grain products and that some of the animal feeds which are commonly used for poultry feeding are deficient in ash and are improved by the addition of bone meal.

Crushed oyster shells are often recommended to supply lime for laying hens, but the results of our experiments indicate that bone meal is a much better source of lime than oyster shells.

WHAT CONSTITUTES A GOOD RATION

A good ration must contain the feed nutrients necessary for the support of the body and the production of the desired product, whether it be meat or eggs. It must also supply these in a form which is palatable or which is relished by the hens, and must be derived from products which are not too high in price.

In addition to the ration which will fill these conditions, it is necessary to have a good supply of green feed for the hens, which serves a double value. In addition to its food value, must be added the benefit it gives in keeping the fowls in good health, thereby enabling them to get the best results from the more concentrated part of the ration.

This is especially true where corn supplies the larger part of the ration, as it does in many cases, especially on the farm.

In most places in this State the condition of high-priced feeds and a limited variety has to be met.

Corn can be had everywhere and hens relish it as well as any other grain, but it is not a good exclusive feed for any animal. It is true that on many farms practically nothing else is fed to the poultry and they get along and at some seasons give a fairly good supply of eggs. The eggs generally come at the season of the year when the hens can

find a great deal of their feed in the fields. It will be found by examining the tables that follow that the hens that depended largely on corn did not give many eggs and what they did give cost more to produce than they could be sold for.

Wheat is not generally as available as corn and is usually higher in price. It is well liked by fowls and is, perhaps, the best grain for poultry feed if one is confined to one kind. It is specially good for warm weather, as it does not contain as much of the heating materials as corn.

When it can be secured at a price which permits of its being used for poultry feed we like to feed wheat for one-third of the grain ration during winter and increase the proportion as the weather gets warmer till we feed two-thirds wheat and one-third corn.

We have confined our grain ration to corn and wheat because they are the only grains that can be secured regularly. Marketable wheat can not always be used because the price is often too high. When this condition arises, substitution of wheat screenings for wheat is made.

Oats are not often fed, as the price is generally higher than can be afforded. When they can be had at a cent and a half a pound they may be used to advantage. They are not as well liked by the fowls as either corn or wheat, and fowls that have not been accustomed to them do not eat them freely if supplied in a mixture of grains. Crushed or ground and fed in the mash they are eaten quite readily, and it is usually preferred to feed them in this way.

Corn and wheat make up by far the largest part of our feeding stuffs, as not only were the fowls fed these two grains whole, but in most of the rations corn meal and wheat bran formed the base of the mash.

The variation in the ration was made in the products used to supply protein and ash. For this purpose meat meal, cotton seed meal, and bone meal were used.

The meat meal used was guaranteed to contain 85 per cent protein and 7 per cent fat. Analysis showed that it went slightly over these figures.

This was a very concentrated meal, carrying nearly as much protein as dried blood.

According to the common practice of buying animal feeds by their protein content it was cheaper than a 55 per cent beef scrap which cost one-half cent per pound less. The results obtained showed that it was lacking in ash and very much cheaper egg production and better development of the fowls was obtained when bone meal was added to the ration.

The cotton seed meal used was the regular meal sold for fertilizing and feeding purposes and which under the State law must contain 7.5 per cent ammonia or 38.58 per cent protein.

The bone meal contained—

Phosphoric acid	20.22 per cent.
Lime	28. per cent.
Protein	26.47 per cent.

It was used primarily for the phosphoric acid and lime which it contained, but the analysis showed that it also carried considerable protein.

In all feeding experiments, an effort has been made to keep the rations as simple as possible and to use only products that the farmer raises or can obtain on the local market.

Rations which necessitate the buying of half a dozen different products may be good, but there is not much likelihood of the farmer using them on account of the trouble in getting the different ingredients.

METHOD OF FEEDING

For the same reason, a system of feeding that would not require too much labor on the part of the feeder has been aimed at.

It has been demonstrated that fowls do better where they have part of their ration of grains, either whole or cracked, and part of it of ground products or what is commonly called a mash. Until within the last few years, it has been the custom to feed this mash wet. This necessitated the mixing of the mash fresh for each feeding and required a great deal of extra work in mixing and feeding. On this account the farmer has never taken to the feeding of mash. With the introduction of the feeding of this part of the ration dry, from hoppers or feed boxes, the objection to it has been largely done away with and it can now be fed with less labor than can grain. Enough mash can be mixed and put in the feed boxes to last for a week or ten days with no more work than was necessary for the feeding of the day's ration under the old method. Not only is there this great saving in labor, but it has been shown that hens return a greater profit on the dry-mash-hopper feeding system than on the wet mash, without taking into account the labor in either case.

In some of our feeding experiments with cotton seed meal, it was found that the hens did not eat the mash freely, and it was thought that by feeding a wet mash or fermenting the cottonseed meal with yeast, as has been done in some other feeding work with cottonseed meal, this trouble might be avoided, but the work necessary to prepare the mash in this way would have been very much against it in everyday use, and it was not tried.

Fig. 7 shows the box from which the mash is fed. This is a home-made box and serves the purpose very well. It would be improved by putting the slats on the inside of the front and having a wire screen to cover the front at night to keep out rats.

Fig. 8 shows a galvanized iron feed box in which the food is covered by a grating of expanded metal. The hens get their food

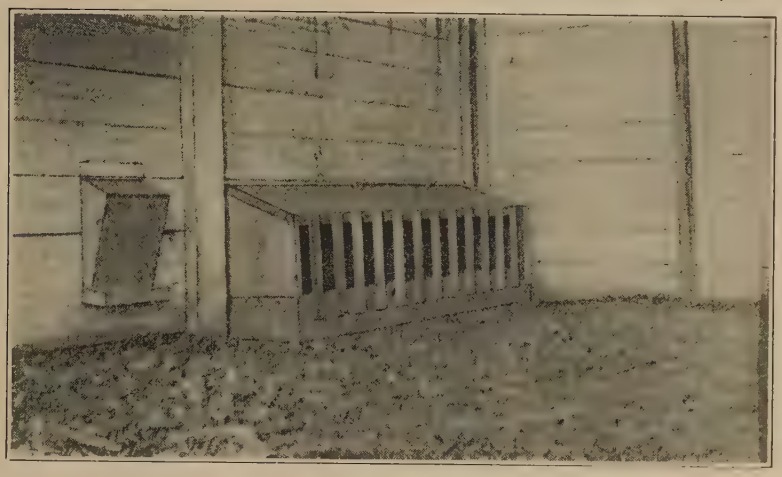

FIG. 7—Home made box for feeding dry mash.

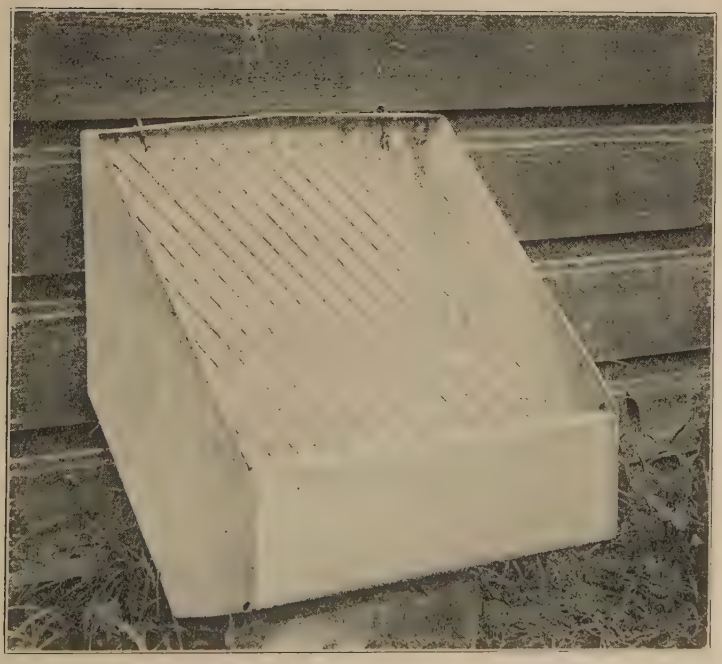

FIG. 8—Galvanized iron feed box for dry mash.

through this grating and are thus prevented from pulling a part of the mash out of the hopper in their search for the ingredients they like best. By hooking the lower end of the grating up at night, the hopper is made rat-proof.

FOWLS USED

With the exception of pen 21, which was made up of Buff Orpingtons, all the fowls used in these experiments were Barred and Buff Plymouth Rocks.

In all cases except pens 24 and 25, one pen each of Barred and Buff Plymouth Rocks were fed on each ration in order to eliminate as far as possible any difference due to the variety. In lots 24 and 25, only one pen was fed on each ration.

Pens Nos. 1, 2, 12, 13, 14, 15, 20, 21, 24, and 25 were pullets when the experiment started. Pens 22 and 23 were yearling hens. Each pen contained ten females and one male at the beginning of the experiment.

RATIONS

The grain fed all pens consisted of a mixture of corn and wheat in the proportions of two to one.

The mash varied in the different pens and was as follows:

Pens 1 and 2	Corn meal	4 parts.
	Wheat bran	4 parts.
	Wheat middlings	4 parts.
	Bone meal	2 parts.
With meat meal in hopper at all times.		
Pens 12 and 13	Corn meal	4 parts.
	Wheat bran	4 parts.
	Meat meal	2 parts.
Pens 14 and 15	Corn meal	4 parts.
	Wheat bran	4 parts.
	Meat meal	2 parts.
	Bone meal	2 parts.
Pens 20 and 22	Corn meal	4 parts.
	Wheat bran	4 parts.
	Cottonseed meal	4 parts.
Pens 21 and 23	Corn meal	4 parts.
	Wheat bran	4 parts.
	Cottonseed meal	4 parts.
	Bone meal	2 parts.
Pen 24	Corn meal	9 parts.
	Cottonseed meal	6 parts.
Pen 25	Corn meal	9 parts.
	Meat meal	3 parts.
	Bone meal	3 parts.

The rations were fed the same to both pens from December 1, 1908, to May 31, 1909.

From June 1, 1909, to August 31, 1909, one pen on each ration was continued on the original ration; the other pen was fed skimmilk in place of the meat meal or cottonseed meal which they had been fed during the first period.

All the fowls were yarded. Pens 12, 13, 14 and 15 had rye in the yards. Pens 1 and 2 had a run on a field of rye every third day.

Pens 20, 21, 22, 23, 24 and 25 were allowed a run on oats and clover half of every third day during the winter. Their yards were set in Bermuda grass and this furnished abundance of green feed after the first of May.

From the nature of our lots it was impossible to get exactly the same conditions for all of the lots in regard to green feed, but none of the fowls suffered at any time from lack of this.

TABLE I.—Showing Cost of Feeding Each Pen, Eggs Laid, Gain or Loss in Weight, Cost of Eggs and Deaths in Each Pen, First Period, December 1, 1908, to May 31, 1909.

Pen No.	Cost of Feeding.	Eggs Laid.	Gain or Loss in Weight.	Cost of Eggs.				Deaths.
				Not Considering Weight.	Average of Two Pens.	Considering Weight.	Average of Two Pens.	
1	$6.64	307	—2¾	25.92		27.00		2
2	7.09	422	1½	20.16	22.56	19.68	22.80	0
12	6.20	191	—4¼	38.76		40.92		1
13	7.80	253	7.	37.00	37.56	33.60	37.08	1
14	7.74	481	8	19.20		17.28		0
15	7.36	498	7⅛	17.64	18.48	15.84	16.44	2
20	5.42	225	2⅜	28.92		27.72		1
22	4.55	378	—7⅝	14.40	19.80	16.80	20.88	0
21	5.55	286	—11⅛	23.28		26.40		2
23	6.67	402	—7⅝	19.92	21.24	22.08	26.40	1
24	6.21	148	6⅞	50.28		44.76		1
25	8.46	374	16⅜	27.12		21.94		0

COST OF EGG PRODUCTION

Table I shows the cost of egg production on the different rations for the first period. Each fowl was weighed when the experiment started and at the end of each month till the close of the experiment.

The cost of eggs per dozen is shown after valuing the gain or loss in weight and without taking the weight into consideration. All

feeding stuffs were charged at actual cost in the local market. These prices were as follows:

Corn	$30.00 per ton.
Wheat and wheat screenings	30.00 per ton.
Wheat bran	30.00 per ton.
Wheat middlings	32.00 per ton.
Cottonseed meal	30.00 per ton.
Meat meal	60.00 per ton.
Bone meal	30.00 per ton.
Skim milk	5.00 per ton.

The total cost of food per pen of ten hens varied from $4.55 to $8.46 for the six months. Pen No. 22, which was fed for $4.55 for the six months, produced eggs at 14.40 cents per dozen without taking account of gain or loss in weight. When they are charged with a loss of weight of 7 5-8 pounds, the eggs cost 16.80 cents per dozen.

This was a pen of Barred Plymouth Rock hens that were in good condition at the beginning of the experiment, but lost about three-quarters of a pound each during the six months and only averaged 37.8 eggs each during this time.

A ration on which hens would only produce 37.8 eggs each in six months and lose three-quarters of a pound each in weight must be lacking in some of the qualifications of a good ration. In this ration the greatest fault seemed to be that it was not palatable to the hens, and as a result they did not eat much of it, hence the low cost per hen for feeding.

Pen 25, which cost $8.46 to feed for the six months, laid just about the same number of eggs as Pen 22, making an average of 37.4, but the ten pullets gained 16 3-8 pounds or 1.63 pounds each. The eggs cost 27.12 cents per dozen, not allowing for gain in weight, and 21.94 cents per dozen after allowing for the gain made.

The eggs in this case cost more per dozen than in the former. This ration, while palatable, was too high in price, due to the large proportion of meat meal used.

Pens 1 and 2 were fed corn meal, wheat bran, wheat middlings, and bone meal in the mash and meat meal in a separate hopper. For some reason the amount of meat meal eaten varied greatly at different times, and the results were not so good as where a stated amount was fed in the mash.

Pen 1 had two deaths during the first period and two during the second. This was the highest of any pen in the experiments, and amounted to forty per cent. The first two deaths were due to eversion of the oviduct. Whether there is any connection between these deaths and the large amount of meat meal eaten at certain times during the experiment it is impossible to say. The other two deaths were due to digestive disorders.

The average cost of egg production for the two pens was 22.56 cents per dozen, not estimating weight, and 22.80 cents per dozen

when the weight was considered. The small loss in Pen 1 due to the two deaths was nearly made up by the gain in Pen 2.

Pens 12 and 13, which were fed meat meal without any bone meal, made very unsatisfactory records. There was one death in each pen during the first period and none in the second. The pullets in Pen 12 weighed practically the same each at the end of the first period as at the beginning, and those in Pen 13 gained just about one pound each.

In neither pen was the egg production satisfactory, the averages being only 19.7 and 26.2 eggs each for the six months. The cost of egg production was high, and each pen showed a loss, Pen 12 of 27.6 cents per hen and Pen 13, of 18.9 cents per hen.

Pens 14 and 15 were fed the same ration as Pens 12 and 13, except that bone meal was added to the mash. In Pen 15 there were two deaths, one just a few days after the experiment started and the other in May. Each lot made an average gain of about .8 pound in the six months and laid an average of 48.1 and 54.8 eggs per hen for each pen.

The average cost of eggs for the two pens was 18.48 cents per dozen, not considering weight, and 16.44 cents per dozen allowing for gain in weight.

Pens 20 and 22 were fed on a ration containing cottonseed meal, and a reference to Table I will show that the cost of feeding the hens in these pens was considerably less than for Pens 14 and 15, being $5.42 and $4.55, against $7.74 and $7.36, respectively. As previously stated, Pen 22 was made up of yearling hens, while the other pens were pullets.

Pens 21 and 23 were also fed a ration containing cottonseed meal, but had bone meal in addition to the ration fed to Pens 20 and 22. It will be noted that we did not get the same results in this case from the addition of the bone meal as we did where it was added to a meat meal ration in Pens 14 and 15. The only explanation of these different results from the use of bone meal that can be offered at this time is the much smaller amount of mash eaten by Pens 21 and 23 as compared with Pens 14 and 15.

Table IV shows the percentage of mash to total food eaten by all pens. This shows that in Pens 14 and 15, 45.1 per cent of their total food was mash, while in Pens 21 and 23 only 31.5 per cent was mash. Pens 24 and 25 were fed rations that did not have any bran and had more cottonseed meal and meat meal than the other rations.

Neither of these rations were satisfactory. Pen 24 only laid 148 eggs during six months, and these cost 50.28 cents per dozen, not allowing for gain in weight, and 44.76 cents per dozen when allowance is made for gain in weight. This is the highest price that eggs cost on any of the rations fed during the first period.

Pen 25 laid 374 eggs during the six months and gained 16 3-8 pounds. Egg production was only fair, but gain in weight was the largest of any lot fed.

TABLE II.—Showing Cost of Feeding Each Pen, Eggs Laid, Gain or Loss in Weight, Cost of Eggs, and Deaths in Each Pen, Second Period, June 1, 1909, to August 31, 1909.

Pen No.	Cost of Feeding.	Eggs Laid.	Gain or or Loss in Weight.	Cost of Eggs.		Deaths.
				Not Considering Weight.	Considering Weight.	
1	$2.02	112	—11⅝	21.60	33.96	2
2	3.80	323	12⅝	14.04	9.43	0
12	1.78	65	—5⅝	32.76	42.	0
13	3.62	312	13	13.92	9.30	0
14	2.97	282	1⅜	12.60	12.	0
15	3.41	326	—1⅞	12.48	13.20	1
20	3.61	289	9⅜	15.	11.07	0
22	2.36	119	4⅜	23.88	19.32	0
21	1.76	47	—8⅜	45.36	66.	1
23	2.83	159	—1¼	21.24	22.20	1
24	3.16	323	6	11.70	9.50	0
25	2.62	279	—3¼	11.27	12.(0	0

Table No. II shows the results for the second period, from June 1 to August 31.

In Pens Nos. 2, 13, 15, 20 and 23, skim milk was substituted for meat meal or cottonseed meal, whichever had been used to supply protein.

It will be noted that in all cases the cost of feeding was greater when skim milk was used than it was where the original ration was continued, but in all cases except Pens 14 and 15 the number of eggs laid was greatly increased and the cost per dozen much reduced.

Pens 14 and 15 made the best record during the first period, and there was very little difference between them in either period. In the second period there was a slight advantage with Pen 14, owing to one death in Pen 15.

Comparing Pens 1 and 2 for this period with the first, we find in Pen 1 a decrease of about 4 cents per dozen for the second period when weight is not considered, and for Pen 2 a decrease of 6 cents per dozen, but when allowance is made for gain in weight, Pen 2 produced eggs at 9.43 cents per dozen on the milk against 19.68 cents on the original ration. Comparing Pens 12 and 13, the results are

even more in favor of the milk ration. In Pens 20 and 22, the conditions found during the first period are reversed. Pen 22 during first period produced eggs at 16.80 cents per dozen and during the second period at 19.32 cents. From Pen 20, during the first period, eggs cost 27.72 cents, and during the second 11.07 cents per dozen.

TABLE III.—Showing Cost of Feeding and Eggs Laid per Hen Per Month; Gain or Loss in Weight per Hen and Cost of Eggs per Dozen on Rations Containing Meat Meal, Cottonseed Meal and Skim Milk.

Ration.	Cost of Feeding per Hen per Month.	Eggs Laid per Hen per Month.	Gain or Loss in Weight per Hen.	Cost of Eggs.	
				Not Considering Weight.	Considering Weight.
Meat meal	14.5	7.7	.2	22 20	21.84
Cottonseed meal	8.73	4.8	—.34	22.80	24.24
Skimmilk	9.5	7.5	.53	15.24	12.36

Pen 23 was the only one which did not give good returns on the skim-milk ration. Eggs from this lot cost 22.20 cents per dozen, as against 22.08 cents for the first period.

Pen 24, which had produced only 148 eggs during the six months of the first period at a cost of 44.76 cents per dozen, produced 323 eggs during the three months of the second and at a cost of 9.5 cents per dozen. This ration during the second period consisted simply of corn, corn meal and skim milk.

Table III gives a summary of the results obtained from all pens fed on rations containing meat meal, cottonseed meal and skim milk.

It will be noted that the average cost of eggs on the meat meal rations is much higher than for Pens 14 and 15, where bone meal was used with the meat meal. It was found that the meat meal used did not give good results where no bone meal was used in the ration.

In figuring the gain or loss per hen, the food costs as given on page 56 are used, and it will be noted that these prices are higher than those prevailing in many places, but are the actual costs in this market.

Eggs were valued at 2 cents each all through the year, as this is about the average price obtained by the Station during the year. There is not the variation in price here that is found in many places, according to season. Strictly fresh eggs bring almost as high a price in summer as in winter. Gain or loss in weight was valued at ten cents per pound.

TABLE IV.—For First Period, December 1, 1908, to May 31, 1909, Showing Amount of Different Kinds of Feed Eaten for the Period, Percentage of Mash to Total Food, Cost of Feeding per Hen for the Period. Highest Average and Lowest Egg Yield for Each Pen, Profit per Hen and Average Weight at Beginning and End of Period.

Pen No.	Weight of Feed.			Per Ct. of Mash to Total Feed.	Cost of Feeding per Hen.	Egg Yield.			Profit per Hen.	Average Wt.	
	Grain.	Mash.	Animal Feed.			High't	Average	Low'st		Begin'g of Period.	End of Period.
1	244	85	53	36.1	76.6	64	35.45	8	—5.9	4.42	5.18
2	272	103	47	35.5	70.9	54	42.2	29	8.5	4.98	4.56
12	274	126	-------	31.5	64.2	34	19.7	1	—27.6	4.05	4.02
13	278	201	-------	41.9	80.7	38	26.2	12	—18.9	3.6	4.66
14	263	222	-------	45.7	77.4	85	48.1	23	29.3	4.85	4.96
15	255	204	-------	44.4	81.9	85	54.8	40	40.	3.77	5.26
20	276	84	-------	23.3	59.1	33	24.5	5	—5.5	3.37	4.36
21	233	112	-------	32.4	65.3	58	33.6	1	—10.	4.16	4.28
22	213	84	-------	28.2	45.5	56	37.8	8	25.6	4.88	4.12
23	275	122	-------	30.7	69.5	98	41.8	0	9.7	5.58	5.39
24	276	120	-------	30.3	63.2	47	15.5	0	—24.	3.4	4.54
25	264	275	-------	51.	84.6	57	37.4	15	9.7	3.78	5.42

Table V.—For Second Period, June 1, 1909, to August 31, 1909, Showing Amount of Different Kinds of Feed Eaten, Percentage of Mash to Total Food, Cost of Feeding per Hen, Highest Average and Lowest Egg Yields, Profit per Hen and Average Weight at Beginning and End of Period.

Pen No.	Weight of Feed.			Per Ct. of Mash to Total Feed.	Cost of Feeding per Hen.	Egg Yield.			Profit per Hen.	Average Wt.	
	Grain.	Mash.	Animal Feed.			High't	Average	Low'st		Begin'g of Period.	End of Period.
1	73	41	Meat Meal 9	40.6	31.9	32	17.7	11	4.9	5.18	4.98
2	87½	80½	S'm M 432	47.5	36.	48	32.3	12	31.2	4.56	5.82
12	66	47	-------	41.5	20.9	23	7.6	0	—.5	4.02	3.82
13	91½	103	432	52.	40.2	40	34.6	10	32.	4.66	6.22
14	95	89	-------	48.3	29.7	36	28.2	4	29.	4.96	5.14
15	66½	87	432	56.6	42.2	53	46.1	28	53.8	5.26	5.75
20	90½	83	432	47.8	45.1	46	36.1	24	30.1	4.36	5.65
21	66½	40½	-------	37.8	22.9	22	6.1	0	—10.18	4.28	3.69
22	80	49	-------	38.	23.6	21	11.9	0	1.2	4.12	4.56
23	83½	81	432	49.2	40.4	48	24.8	0	10.1	5.39	6.52
24	64½	73	432	53.1	35.1	52	38.6	15	45.4	4.54	5.21
25	55	100	-------	64.5	26.2	44	27.9	16	31.9	5.42	5.10

Tables IV and V give the amount of food of each kind eaten by each pen for the two periods, the percentage of mash to total food eaten, cost per hen of feeding during each period, the highest, lowest and average egg yield, profit per hen and average weight of fowls at beginning and end of each period.

This latter point will not agree with gain or loss of weight given in Tables I and II, as in this case the average of the fowls actually in pens at the end of period is given, while in the former the total weight of fowls is taken.

For example, take Pen 1. Table I shows a loss in this pen for the first period of 2 3-4 pounds, while Table IV shows a gain in the average weight of .762 pounds each for the six months. The loss in weight in the first case being caused by the two deaths which occurred. A comparison of the value of the different rations can be made by all these tables, but perhaps the best is that shown by Tables IV and V between Pens 15 and 20.

These were two pens of Barred Plymouth Rock pullets of the same breeding and as nearly alike in age and development as it was possible to get them. The ten pullets in Pen 15 weighed 34 1-4 pounds, and those in Pen 20, 33 3-4 pounds.

During the first period, Pen 15 ate 255 pounds grain and 204 pounds mash, at an average cost of 81.9 cents per pullet. Pen 20 ate 276 pounds of grain and 84 pounds of mash at an average cost of 59.1 cents per pullet. Pen 15 laid an average of 54.8 eggs each for the period, gained 1.495 pounds each and made a profit of 40 cents each. Pen 20 laid 24.5 eggs each, gained .985 pounds, and lost 5.5 cents each.

For the second period the rations were the same, except that Pen 15 had bone meal and 20 had none. Pen 15 ate 66½ pounds grain, 87 pounds mash and 432 pounds milk, at a cost of 42.25 cents for each pullet.

Pen 20 ate 90½ pounds grain, 83 pounds mash and 432 pounds milk at a cost of 45.1 cents each. Pen 15 averaged 46.1 eggs each, gained .485 pounds each and made a profit of 53.79 cents each for the three months.

Pen 20 averaged 36.1 eggs, gained 1.29 pounds and made a profit of 30.1 cents each.

It will be noted that these pullets weighed practically the same at the beginning of the first and end of the second period, but at the end of the first period those in Pen 15 weighed .90 pounds each more than those in Pen 20. These latter were not in as good condition at the beginning of the second period as those in Pen 15, and more of their food went to building them up. They gained .805 pounds each more than the others, but laid 10 eggs each less.

The results obtained from Pens 24 and 25 for the two periods should also be noted.

For the first period (six months) Pen 24 laid 148 eggs that cost 44.76 cents per dozen, and made a loss of 24 cents each for the period.

For the second period (three months) this pen laid 323 eggs, which cost 9.5 cents per dozen, and made a profit of 45.4 cents each. The only change in the ration being the substituting of skim milk for cottonseed meal.

Pen 25, in which the original ration was continued through both periods, laid during the first period 374 eggs which cost 21.94 cents per dozen and made a profit of 9.7 cents each in six months. In the second period they laid 279 eggs, which cost 12.60 cents per dozen and made a profit of 31.9 cents each.

Pens 20 and 22 had the same ration for the first period, but for the second cottonseed meal was replaced by skim milk in the ration for Pen 20. Pen 22 was continued on the original ration.

For the first period Pen 20 laid 225 eggs and Pen 22, 378. In Pen 20 eggs cost 27.72 cents per dozen and in Pen 22 they cost 16.80 cents per dozen.

In Pen 20 the hens lost 5.5 cents each, while in Pen 22 they gained 25.6 cents each during the same time.

For the second period, Pen 20 laid 361 eggs at a cost of 11.07 cents per dozen, while Pen 22 laid 119 at a cost of 19.32 cents per dozen. Hens in Pen 20 gained 30.1 cents each and those in Pen 22 gained 1.2 cents each.

CLEANLINESS

It is quite possible to have the best stock, kept in well-built houses, well fed, and still not get any profit or pleasure from them. In too many cases where a good start has been made the house is neglected and allowed to become filthy and infested with mites. It may be said that filth and mites generally go together, for while a house that is kept fairly clean may be infested with mites, it is very seldom that a dirty house will be found to be free from these pests.

Lice and mites cause more losses among poultry than all other things combined. This is especially true of Southern poultry, as a hot climate is especially favorable to the rapid increase of these parasites.

In the remarks about houses some suggestions were made as to how the house should be arranged inside to enable the poultryman to keep down the mites without an undue expenditure of time and energy. Mites live in the house and must be killed there. Dusting the hens will never get rid of them.

The best means of getting rid of mites in the houses is to spray thoroughly with kerosene emulsion. This should be done twice with an interval of from five to seven days between the sprayings.

The emulsion is made as follows: Cut up one pound of soap and dissolve it in hot water; while the water is hot, stir in two gallons

of kerosene and continue stirring for fifteen to twenty minutes. It is important to have the kerosene, soap and water well mixed, especially if it is not to be used at once. To this mixture add seventeen gallons of water. This makes a ten per cent emulsion. Some recommend fifteen per cent, but we have found ten per cent efficient in killing the mites.

Kerosene used on the roosts once a week in hot weather will help to keep down both mites and lice. If put on a short time before the hens go to roost, some of it will get on the feathers and will kill and drive away lice. Care must be taken not to get too much on the fowls, or it will blister them and this will stop the hens from laying just as much as the lice will. Good, vigorous hens kept in a clean house and given a good place to dust and wallow in should not need any special attention to keep them free from lice. The dusting with insect powder of a large number of hens is a tedious and disagreeable job, and with proper conditions should not be needed. Hens that are not vigorous and those that are sick will often be found to be lousy, and many think that the lice make them sick. Lice are the result rather than the cause of sickness. When the hen becomes sick she is not able to defend herself and becomes an easy prey to lice. In a case of this kind, and when hens are set, they need dusting with a good insect powder, but there is something wrong with the stock and the management if frequent dustings are necessary.

When it is necessary to use an insect powder, care should be taken to get one that will kill the lice without injuring the hens. Some of the insect powders put up especially for poultry use are so strong that they will injure the hens. A few years ago, at the Experiment Station, a setting hen was killed by the liberal use of a powder that contained considerable naptholin flakes, and just this spring hens were killed near here by the use of insect powder of the same make, and some that did not die were so injured that they stopped laying for two to three weeks. The parties dusted their hens to kill the lice in the hopes of getting a better egg yield, but the results were that the egg yield instead of increasing fell off about fifty per cent for ten days after the use of the powder.

Pyrethrum or Persian insect powders may cost more, but they are better and are not so dangerous to use as are the powders which depend largely on naptholin to kill the lice.

CONCLUSIONS

The following conclusions may be drawn from the feeding experiments conducted during the past season:

Cottonseed meal is not relished by hens as well as the animal sources of protein are. On that account is not as well adapted to

poultry feeding, as the fowls ate very sparingly of the mash containing it.

Pullets were slower in developing and in coming to laying maturity on a ration containing cottonseed meal than on one containing meat meal.

Hens did better than pullets on rations containing cottonseed meal, as shown by Pens 20 and 21 in comparison with Pens 22 and 23, the latter two being hens. As far as can be judged from the work done, the main objection to cottonseed meal is its lack of palatability.

High protein meat meal, although readily eaten by the fowls, did not give satisfactory results either in egg production or development of the fowls.

Lime furnished by oyster shells did not supply the deficiency of ash in some of the rations, as all pens had oyster shells available at all times.

The best results in egg production during the first period were obtained from the two pens fed a mash containing meat meal and bone meal.

During the second period the best results were obtained from the pens fed skim milk.

Rations which gave the lowest cost per hen for feeding did not give the greatest profit per hen during either feeding period.

During the first period, Pen 22, which was fed at a cost of 45.5 cents per hen for six months, came third in profit per hen. Pens 14 and 15, which cost 77.4 cents and 81.9 cents per hen, respectively, gave a greater profit per hen for the period.

During the second period the three pens that were lowest in feed cost were Nos. 12, 21 and 22. The first two were fed at a loss and the last at a profit of only 1.2 cents per pen.

Pen 15, which cost more than twice as much per hen to feed, gave a profit of 53.79 cents per hen for the three months.

Hens fed skim milk during the second period not only laid more eggs at less cost per dozen, but gained more in weight and came to moulting time in better condition than those on any other ration.

Bone meal did not seem to be as necessary when skim milk was fed, as Pens 13 and 24 gave good returns during the second period. The mash for the former was corn meal and wheat bran and for the latter corn meal only.

The pens fed skim milk during the second period cost more per hen for feed, but gave better returns for feed consumed than those on other rations.